U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Keysseria erici*

COMMON NAME: No common name

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

__X_ Continuing candidate

___ Non-petitioned

_X__ Petitioned - Date petition received: May 11, 2004

__ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1999

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Asteraceae (Sunflower family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

LAND OWNERSHIP: All populations are on State-owned land

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Keysseria erici* is a short, rhizomatous perennial herb. Scapes are tinged purple, 3 to 15 centimeters (cm) (1.2 to 6 inches (in)) long, hirtellous and villous. Leaves are in a basal rosette, oblong, 0.8 to 1.3 cm (0.3 to 0.5 in) long, 0.2 to 0.45 cm (0.08 to 0.2 in) wide, and with golden or purplish hairs. Flower heads are solitary, 6 to 10 millimeters (mm) (0.2 to 0.4 in) in diameter, with rays white or sometimes tinged purple, entire or deeply and asymmetrically lobed, with globose glands. Corollas are yellow, lobed, 1.8 to 2.7 mm (0.07 to 0.1 in) long, with globose glands. Achenes are somewhat compressed, with a conspicuous cartilaginous ring at maturity, 1.2 to 1.7 mm (0.05 to 0.07 in) long, and with globose glands near the apex (Mill 1999).

Taxonomy Forbes originally placed this species in the genus *Lagenifera* which was upheld by Mill in Wagner *et al*. (1999). However, in the 2003 supplement to the *Manual of the Flowering Plants of Hawaii* the authors upheld Nesom's understanding of the differences between *Lagenifera* and *Keysseria* and recognize the taxon as a species of *Keysseria.* Wagner and Herbst's (2003) supplement represents the most recently accepted Hawaiian plant taxonomy.

Habitat *Keysseria erici* is found in moist but not flooded areas of bogs at elevations between

1,065 and 1,550 meters (3,494 and 5,085 feet) (Wagner *et al*. 1999a).

Historical and Current Range/Current Status *Keysseria erici* is known from several populations in numerous bogs within the Alakai swamp region of Kauai, totaling approximately 1,000 individuals. While the species has always been restricted to the bogs of the Alakai, it may have occurred in more bogs in the area in the past. Due to inclement weather, staff of the U.S. Fish and Wildlife Service (Service) and the Hawaii Division of Forestry and Wildlife have only been able to intermittently conduct the projected biannual monitoring of this species. However, in each of the last four years we have monitored the three populations within fenced bogs and these populations and number of individuals have fluctuated very little (Steve Perlman, National Tropical Botanical Garden, pers. comm. 1996; Marie Bruegmann, Service, pers. comm. 2004 and 2005).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.
Pigs (*Sus scrofa*) are the major threat to *Keysseria erici* (Perlman and Wood 1995). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on Kauai. Pigs are currently present on Kauai and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al*. 1986; Scott *et al*. 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al*. 1999a). Pig exclusion fences protect three of the several known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Therefore, even though we have no evidence of browsing for this species, it is likely that pigs impact unfenced individuals of this species directly as well as their indirect impacts to the surrounding habitat.

D. The inadequacy of existing regulatory mechanisms.
The Forest Reserve Act of 1903 was an important action that protected watersheds in Hawaii.

This act has been strengthened and re-titled Hawaii Department of Land and Natural Resources Title 13, Chapter 104 Rules Regulating Activities within Forest Reserves and provides protection to native forest values from certain degrading factors caused by human activities such as camping and timber harvest. The Hawaii Department of Land and Natural Resources Regulation (Administrative Rule No. 1, Chapter 3) established the 4,022 hectare (9,939 acre) Alakai Wilderness Preserve in 1964, recognizing the pristine forest values of that area and the need to control potential degrading factors. No funding was obligated along with this law to allow Hawaii Department of Land and Natural Resources to adequately manage the area.

Pigs are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers. Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Lands and Natural Resources n.d.-a, n.d. b, n.d.-c, n.d.-d). However, public hunting does not adequately control the number of ungulates to eliminate this threat to native plant species. Pig exclusion fences protect three of the several known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.
While introduced plant species are not as large a threat to *Keysseria erici* as feral pigs, there are a few species (discussed below) which are invading the bog habitat of the species. The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Confirmed personal observations (Perlman and Wood 1995) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *K. erici*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the bog habitat of *K. erici*, the Service believes nonnative plant species are a threat to this species. Nonnative plants have been greatly reduced in all three fenced bogs, and are not found in the immediate vicinity of any *Keysseria erici* individuals. These on-going conservation efforts for this species benefit only three of the several known populations.

Juncus planifolius (no common name) is a perennial rush which has naturalized in moist, open, disturbed depressions on margins of forests and in bogs on Kauai, Oahu, Molokai, Maui, and Hawaii (Coffey 1999). *Juncus planifolius* is only found in disturbed areas, so the removal of

feral pigs will most likely stem the spread of this species (Perlman and Wood 1995; S. Perlman, pers. comm. 1997).

Andropogon virginicus (broomsedge) is a perennial, tufted grass, which is naturalized on Kauai, Oahu, and Hawaii along roadsides and in disturbed dry to mesic forest and shrubland (Clyde Imada, Bernice Pauahi Bishop Museum, pers. comm. 1997; O'Connor 1999). The saturation of soil in the bogs creates a lack of oxygen, which inhibits the uptake of water by plant roots, resulting in drought conditions (Joan Canfield, Service, pers. comm. 1996). Broomsedge is beginning to establish in the bogs of the Alakai that are most easily accessible to humans, including some of those where *K. erici* occurs (Perlman and Wood 1995).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service, working in cooperation with the State of Hawaii, Division of Forestry and Wildlife, has fenced three of the bogs in which *Keysseria erici* occurs. Funding was made available from the Service's Portland Regional Office in fiscal year 1995 to begin this work, and the Service has conducted intermittent biannual weeding and monitoring, but additional funding will be required for annual fence maintenance, monitoring, and weed control.

SUMMARY OF THREATS

The major threats to this taxon are pigs and nonnative plant species. Feral pigs have been fenced out of three of the bogs where *Keysseria erici* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been greatly reduced in all three fenced bogs, and are not found in the immediate vicinity of any *Keysseria erici* individuals. These on-going conservation efforts for this species benefit only three of the several known populations. The unmanaged populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:
Magnitude:
This species is highly threatened by pigs that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Threats to montane bog habitat of *Keysseria erici* and to individuals of this species occur throughout its range, and are expected to continue or increase without control or eradication. Feral pigs have been fenced out of three of the bogs where *K. erici* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been greatly reduced in all three fenced bogs, and are not found in the immediate vicinity of any *K. erici* individuals. These on-going conservation efforts for this species benefit only three of the several known populations. The other, unmanaged populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

Imminence:
Threats to *Keysseria erici* from pigs and nonnative plants are imminent because they are ongoing in the bogs that are not currently fenced.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, three of the several populations of *Keysseria erici* have been fenced, and are monitored and weeded biannually, weather and funding permitting, by the Service and the State's Division of Forestry and Wildlife. Within the fenced bogs, the number of individuals has remained relatively stable. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *K. erici* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:
We have incorporated additional information on this species from our files, including personal communications with Steve Perlman, National Tropical Botanical Garden in 1996 and 1997; Clyde Imada, Bernice Pauahi Bishop Museum in 1997, and Joan Canfield, Service in 1996. In addition, we have incorporated information from the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. New information on status and management was provided by Marie Bruegmann, Service, in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Keysseria*

erici was provided by Marie Bruegmann, Service.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be at risk) by Wagner, *et al.* (1999b).

This level of monitoring is appropriate to update the status of the species, since the populations are monitored in detail one to two times a year by the Service and Hawaii Division of Forestry and Wildlife and the results are included in this assessment.

COORDINATION WITH STATES

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for *Keysseria erici* and suggested that this species may meet the interim recovery objectives for Hawaiian plants, and therefore may not warrant listing. The interim recovery objectives for a short-lived species such as this taxon are aimed at stabilizing the species and preventing extinction in the near future, and include 1) the existence of 3 populations of 50 reproducing individuals each, 2) all threats managed and, 3) the species in genetic storage. While the populations have numbers greater than 50 reproducing individuals each, threats are not being controlled in all of the populations and no genetic storage has been conducted to date. Therefore, we believe listing is warranted for *K. erici.*

LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood	June 28, 2005	National Tropical Botanical Garden
10. Marie Bruegmann*	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden,

Honolulu. 468 pp.
Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.
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Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.
Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai`i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.
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Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
Hawaii, Department of Land and Natural Resources. N.d.-d. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Kauai. Division of Forestry and Wildlife, Honolulu.
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Loope, L.L., A.C. Medeiros, and B.H. Gagné. 1991. Recovery of Vegetation of a montane bog following protection from feral pig rooting. Coop. Natl. Park Resources Studies Unit, Univ. Hawaii/Manoa, Dept. Of Botany, Tech. Rept. 77.
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Hawaiian Islands. Bishop Mus. Occas. Pap. 48: 23-36.
Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
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Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9: 1-429. Cooper Ornithological Society, Los Angeles.
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of Hawai‘i, version 3.1. December 12, 2003. Available from the Internet. URL: http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm.

Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/16/05
Regional Director, Fish and Wildlife Service Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: September 16, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 23, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 13, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 13, 2005
Field Supervisor